

WRITTEN TESTIMONY OF

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***“Plant Biotechnology Research and Development in Africa:  
Challenges and Opportunities”***

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Thank you, Hon. Chairman, Nick Smith and Hon. Eddie Bernice Johnson, ranking minority member, for providing me with the opportunity to speak to you and members of the Subcommittee on Research of the U.S. House of Representatives' Committee on Science regarding “Plant Biotechnology Research and Development in Africa: Challenges and Opportunities.”

The tragic truth is unavoidable: Africa is losing the war against famine. Despite the enormous potential of plant biotechnology to improve food production, Africa is losing the war against hunger. As USAID Administrator Andrew Natsios has noted, an estimated 435 million Africans could face “severe food insecurity” by the year 2010,

And yet, this doesn't mean that plant biotechnology has failed in Africa. On the contrary, plant biotechnology has not been given a chance to work its wonders in Africa – and that is almost as terrible a tragedy.

Why hasn't plant biotech been given a chance? Although it is tempting to blame the European Union's moratorium on GMOs for Africa's rejection of biotech, more fundamental -- and more troubling -- factors are responsible. Even after the European Union ends its moratorium on GMOs – as surely it will, -- plant biotechnology will have a bleak future in Africa unless we develop a clear road map to address the root causes of this crisis – rather than its symptoms.

In my view, developing a road map for creating sustainable biotechnology applications that eliminate food insecurity in Africa must consist of the following steps:

**1). We must focus on financial support of a long-term strategic plan; not on making short-term investments. This will require developing a process for coordinating all the efforts of foreign assistance that are currently provided to Africa by various U.S. agencies.**

**2). We must revive and rebuild Africa's battered capacity for applied research, and make research institutions a cornerstone of our efforts. This process should encourage a spirit of entrepreneurship – and the incubation of private-sector companies that commercialize innovations that come out of applied research centers at Africa's universities.**

**3). We must focus on applied research to solve problems that Africans themselves identify as essential – and relevant -- to the famine crisis. Africans must be involved at every stage of planning and implementation.**

**4). We must rebuild Africa's battered infrastructure for agricultural extension at a time when it is more essential than ever.**

**5). We must help Africans create legal certainty, predictability and transparency to help spur investment from the public sector, and to nurture an entrepreneurial spirit.**

We must act with a sense of urgency, because the gap between the technology "haves" and the "don't-haves" is expanding daily. As technology becomes increasingly sophisticated, that gap will continue to widen – unless we act decisively.

Allow me, please, to elaborate my approach in a bit more detail.

### **An Emphasis on the Long-term**

First, instead of continuing to apply short-term "fixes," we need to focus on long-term strategic investments. We need to patiently nurture and rebuild African university institutions -- and work with African policymakers to help them understand their options for making decisions about biotechnology research – and its enormous potential for eliminating hunger, and fueling economic development. We must assist African universities with both financial and strategic planning so as to rebuild Africa's deteriorated university systems.

The consequences of a long-term approach are profound. We need to evaluate biotechnology options and technologies -- not by assessing how much they will pay off this year or next year, but on the basis of how they may contribute to solving the hunger problem five years or ten years -- or even further down the road.

Although this means taking risks – and betting on uncertain, new options – we cannot afford not to take risks, if we want to develop long-term meaningful solutions. If we don't think long-term, there is no doubt that we – or our

counterparts – will be discussing the issue of African famine in even more dire terms, some ten or twenty years from today.

To monitor the progress of our long-term approach, we also need a process for coordinating the efforts of various U.S. agencies – in order to make sure that their programs are consistent, and there is no redundancy.

### **Focusing on Applied Research**

Next, we must rebuild Africa's battered infrastructure for applied research, and make it a cornerstone of our long-term efforts. Africa's infrastructure for applied research in biotechnology is in tatters. Biotechnology budgets have dried up, and professional standards have declined to the point where advanced research is virtually non-existent.

In a recent study, Dr. Walter S. Alhassan, a Visiting Scientist at the International Institute of Tropical Agriculture (IITA) in Ibadan, Nigeria, pointed out that the National Agricultural Research Systems (NARS) of the following seven African countries have no capacity to conduct advanced biotechnology: Burkina Faso, Cameroon, Côte d'Ivoire, Ghana, Mali, Nigeria, and Senegal.

Elsewhere, the situation is similar, except for in South Africa. How can we expect advanced research to take place? Consider that:

- African scholars are poorly paid.
- Libraries lack modern research tools such as computerized databases.
- Research institutions lack Internet connectivity.
- African scholars are isolated from the main currents in their discipline both within Africa and across the globe, and
- There is no credible legal system to protect innovations of Africans through fundamental international standards such as the WTO Agreement on Trade Related Aspects of Intellectual Property rights.

We know that it doesn't have to be this way – because from the 1960s through the 1970s, it wasn't. During that period, many African universities enjoyed a significant budget for applied research. Most African governments spent at least one percent of their GDP on scientific research. Today, you would be hard pressed to find even five governments that spend as much as one percent of their GDP on research. Many governments only spend one-tenth of one percent.

A generation ago, professional standards were high. Moreover, Africa's researchers had ample opportunity to engage in exchange programs with their counterparts in the United States and Europe. Many Americans took sabbaticals in Africa, as did some of their counterparts in Europe. These reciprocal exchanges strengthened the skills of African professionals, and kept them up-to-date with their colleagues elsewhere around the world.

What went wrong? It's easy to point fingers. Civil wars. Corrupt, self-serving governments that are repressive and ill informed about biotechnology. Even the World Bank, in pursuit of "structural adjustments," put pressure on African governments to discourage research and higher education in favor of shorter-term approaches. Now I am glad to see that they are reversing that policy, and recognizing the importance of quality research and high standards.

In any case, finger pointing won't get the job of rebuilding done.

So where do we start? Across the continent, several of Africa's leading universities and research institutions still have considerable potential to emerge as centers of quality research in plant biotechnology – provided that we make a patient, long-term commitment to funding – and guiding-- their progress along the right path. According to the same study by Dr. Alhassan, The West and Central African Council for Agricultural Research and Development (WECARD)<sup>1</sup> recognizes the importance of biotechnology for agricultural research in the region.

Some highlights of Dr. Alhassan's study:

- There is considerable strength in tissue culture and a growing potential for molecular biology work in Cameroon.
- Except for a shortage of manpower, the infrastructure for biotechnology in Côte d'Ivoire is above average for the subregion.
- In Ghana, the biotechnology infrastructure is weak but the manpower base is relatively strong.
- Nigeria has a strong infrastructure in tissue culture work, but it is relatively weak in molecular biotechnology infrastructure. However, this will develop over time, as Nigeria draws up its guidelines for biotechnology development policy and biosafety, and as it establishes institutions to promote biotechnology research and joint development with emerging local entrepreneurs.

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<sup>1</sup> CORAF (Conseil Ouest et Centre Africain pour la Recherche et le Développement Agricoles)

- Senegal has the best laboratory infrastructure and manpower for agricultural biotechnology in the subregion. Its standard of biotechnology work is relatively more advanced than the neighboring countries.

Several African universities have considerable potential, if their infrastructures are provided with additional support. Among these, I would include the University of Botswana – which has one of the best chemistry departments in Sub-Saharan Africa except for in South Africa -- and Ahmadu Bello University in Nigeria, which is headed by a no-nonsense administration that is looking for funding to engage in applied research in biotechnology. Other universities with significant promise include the University of Yaoundé (Cameroon); the National University of Côte d'Ivoire; Addis Ababa University in Ethiopia; Omar Bongo University in Gabon; the University of Ghana; the University of Namibia; University Cheikh Anta Diop of Dakar, Senegal; and Makerere University in Uganda, the country in which I was born.

A number of African research institutes, as well as institutes within ministries of agriculture, are also in a position to emerge as applied research centers in plant biotechnology. Most remarkable is the Kenya Agriculture Research Institute (KARI), which is already engaged in a fruitful partnership with the USAID and the private sector. The fruits of that partnership are already apparent in the form of genetically modified sweet potatoes.

For an example of how university research can incubate new companies – and strengthen entrepreneurship – the University of the Western Cape, in South Africa, can serve as a role model. At that university, the South African National Bioinformatics Institute (SANBI) is developing a bioinformatics analysis site, and using it as an incubator for new companies. The mission of SANBI is to “develop analysis systems relevant to the South African Community.” Instead of relying on a developed country to come in and rescue Africa from its problems, young companies such as Electric Genetics believe that South African citizens should learn about bioinformatics and help themselves. Gensec Bank and Real Africa Holdings launched the first biotech venture capital fund, Bioventures, in 2001.

We should also do everything in our power to reduce the painful isolation of Africa's scientific community – by fostering exchange programs and sabbaticals that expose Africa's Molecular biologists and biotechnologists to the ferment of new ideas and new technologies in the United States. In this regard, I suggest we leverage the sizable community of African scientists who are permanent residents in the United States, including many U.S. citizens. Many members of this African Diaspora are ready and willing to contribute their skills and perspectives, without necessarily relocating to Africa.

### **Bringing biotech to the heart of the people**

Next, we must bring biotech to the heart of African people rather than create “centers of excellence” that are far away – and far less responsible. Africa needs to bring biotechnology to its grass roots. Technology must be supported by local expertise at local universities that understand local needs.

Sources of knowledge and support must be on the ground, close to farmers – and readily available to support them – not halfway across Africa, as some people have proposed. Imagine poultry farmers in Delaware relying on research support centers in faraway Nebraska or California, instead of centers at the University of Delaware. It's hard to see how that sort of research center can be responsive to the needs of farmers in Africa, who are far more isolated than farmers in Delaware. Moreover, it's a lot cheaper to create three or four first-class institutes in a country than to ask people to bear the impossible cost of traveling abroad for assistance.

On the contrary, local communities must become engaged in making vital decisions about where and how to apply biotech research efforts. Only then – and only after gradual, patient efforts – will plant biotech be viewed as “local” and “African” – rather than alien and threatening.

We must work with local communities to identify their needs, their priorities – and the technologies that are the best fit. Local communities will be the best judges of research projects that are worth pursuing, not faraway institutes that deal with only a handful of scientists from each country.

How exactly can locally focused applied research help? Here are several options that seem especially promising:

First, applied research can help develop new varieties of plants that are critical to African nutrition --- but are currently threatened by disease or biodiversity loss. Although most of the genetically modified organisms intended to be introduced to Africa are in cotton, rice and corn, there is a good opportunity for biotechnology to have a significant impact on the production of cassava, which is currently suffering widespread blight disease in Africa. Cassava is the second most important source of carbohydrates in the world – and the consequences for African famine will be devastating if production drops severely.

During my recent trip to Brazzaville, capital of the Republic of the Congo, I met with the Hon. Ms. Jeanne Dambendzet, the Minister of Agriculture. During our meeting, the Minister expressed her deep concern about the devastation of cassava blight disease in her country. She is very fearful of the impact on local cassava production and how Congolese rural communities will cope with the shortages of food. Madame Ambassador Robin Sanders, U.S. Ambassador to the Republic of the Congo, arranged my trip. Ambassador Sanders is taking a

leading role in assisting the efforts of Congolese leaders to combat the problem of serious cassava blight disease. At the moment, there is no light at the tunnel for solving this blight -- because there is not enough funding directed towards solving the cassava problems in Africa, or anywhere else.

Second, applied research can help local communities effectively cultivate and commercialize many wild products that are popular -- but whose future is threatened by over-harvesting. One such product is Gnetum leaves that are known throughout Central Africa, mostly by the vernacular name koko.<sup>2</sup> Commercial activity in these leaves has been increasing for several years. Today they are sold in most European countries. In all Central African countries, women play a primary role, from gathering to selling. An investigation in 1980<sup>3</sup> found that the trade in Gnetum in the Kailash region of the Congo employed over 400 women to harvest the leaves from the wild. It's a popular but endangered wild plant.

Many Central Africans, especially in Cameroon, Congo, Gabon and the Central African Republic, depend on koko for the nutritional value of its leaves, a significant source of protein, essential amino acids, and mineral elements. Yet koko could soon become extinct if researchers don't get a solid opportunity to apply biotechnology to its cultivation. Hon. Djombo, Minister of Forest Economy and Environment, for the Republic of the Congo echoed these concerns during our recent meeting in Brazzaville.

Next, applied research can help us develop a model for moving biotechnology into local communities effectively. Although biotechnology has the power to enhance valuable traits – and ward off disease — crops that are genetically modified can nevertheless suffer from weeds. So we need research that helps farmers manage their crops that include genetically modified organisms.

Which research projects will turn out to be the most useful? I can't tell you – and neither can anyone else. Only local African communities will be able to make that judgment – and only if their local applied research institutions are allowed to flourish – and share their knowledge. Only if local communities can get involved in monitoring programs – and seeing which projects are really addressing their needs and which are not.

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<sup>2</sup> **Mialoundama, F.**, "Nutritional and Socio-Economic Value of Gnetum Leaves in Central African Forest:" Chapter 14; Man and the Biosphere Series, Volume 13.

<sup>3</sup> **Mialoundama, F.**, (1980). "Action regulatrice des feuilles sur l'activité morphogenetique du bourgeon terminal chez Gnetum africanum Welw." Comptes Rendus des Séances de l'Academie des Sciences; Paris, 291, 509-512.

### **Strengthening infrastructure for agricultural extension services**

In addition, we need to see revive institutions of applied research as the source of agricultural extension services that African farmers need to survive – and thrive – in the age of biotechnology and global markets.

Several factors make agricultural extension more essential than ever before: The faster pace of technological change; the globalization of agricultural markets; and the growing integration of biotechnology with information technology.

These factors make the challenges confronting Africa's farmers today very different from the challenges that faced my father in Uganda when I was growing up in that country.

When I was a child, my father grew tobacco and cotton on a farm that benefited enormously from the "Green Revolution." If it hadn't been for the Green Revolution, my father would not have had the resources to make a good living – and lay the seeds for my higher education and career as a scientist.

Unfortunately, few African farmers today are making the smooth adjustment to new agricultural technologies that my father did during my childhood. Many farmers who have been introduced to new technology are abandoning their farms – because of the failure of today's infrastructure for agricultural extension.

To understand why, consider the fundamental contrast between the Green Revolution and the Biotech Revolution of today – and the greater demands on agricultural extension today. The Green Revolution brought new technology in the form of fertilizers, fungicides, insecticides and herbicides. Although new, these technologies did not require the long learning curve required of today's line-up of new products. They were not only less sophisticated than today's new technologies, they weren't changing rapidly. A fertilizer was a fertilizer; it was not being continually redesigned and improved – like today's products in biotechnology and information technology. Getting a handle on new technology today is harder than ever – because technology is a moving target. Anyone who works with computers knows that.

In my father's generation, it was also much less of a challenge to understand the risks involved in using new technologies, as well as their impact on the economic and social patterns of communities. In those days, African farmers did not have to become skilled in the new art of risk assessment. There weren't as many new products – and the risks were easier to assess. Nor did farmers have to learn about regulatory regimes; or about regional, national – even global economic conditions that affect their livelihood.



Now, at the very time when African farmers must learn continuously in order to survive, agricultural extension services designed to help them have been gutted by budget cutbacks, and other forces we have discussed earlier. At a time when Africa's farmers need more support than ever, the infrastructure for agricultural extension has eroded.

Is it any wonder that many farmers fail to take full advantage of the biotechnology that is made available to them? Is it any wonder that so many abandon their farms – and return to the city? Is it any wonder that they become biotechnology Luddites – rejecting a technology that could do them so much good because they don't have the resources – including funding and skills -- to use it effectively?

Plant biotechnology is constantly changing, and farmers need to understand complex processes of risk assessment. New products are newer and harder to grasp; that is the wonder of biotechnology – but also a challenge for gaining acceptance.

We must also make sure that agricultural extension services are equipped to explain regulatory issues to farmers, as well some of the economic complexities that reflect the influence of the global marketplace. All of these efforts must be continuous – rather than one-shot efforts at training—because everything is always changing.

### **Creating Legal Certainty, Predictability and Transparency**

Research is expensive and we can't depend on governments alone to get the job done. We need to get the private sector actively involved. A key to boosting biotechnology lies in developing strategies for stimulating private-sector investment. However, the current absence of legal certainty, predictability and transparency creates major obstacles to investment for research-intensive industries in the biotechnology sector. Without laws that conform to minimal international standards – such as the WTO Agreement on Trade Related Aspects of Intellectual Property Rights -- businesses are unable to make the investments needed in terms of capital and technology transfer; and in the training and upgrading of local personnel.

In the long run, these factors are critical to sustainable economic diversification and sustainable economic growth. In the absence of protection for trademarks, patents, undisclosed information and copyrights, African countries are unable either to protect the intellectual capital of their own elites or attract foreign capital from innovative multinational companies. The absence of IP protection also contributes substantially to brain-drain. Many of Africa's most talented and capable scientists, doctors and inventors have "voted with their feet." They have emigrated to European and American laboratories or clinical research facilities, where they have greatly enriched global science and technology across many sectors. However, they have been unable to contribute

to the economic development of their home countries, apart from sending remittances.

### **Staying the Course**

If we neglect this approach – and focus on technology, rather than the entire agricultural system – many farmers are likely to throw up their hands in defeat, when they hit their first hard times.

If we continue to focus on the short-term, and neglect the kinds of applied research that can bring science to the people, biotechnology will have a bleak future in Africa. And if we don't focus on bringing biotech to the heart of the people, hundreds of millions of Africans will lose their best chance to stave off famine. But if we act now to take a more strategic, longer-term view, I'm confident that we can turn the corner in the struggle against famine.

### **About GBDI**

Since GBDI was established in 1999, we have conducted multidisciplinary training sessions about biodiversity, biotechnology and related intellectual property law in Kenya, Botswana, Nigeria, Tanzania, and Benin. Overall, nearly 500 scientists, lawyers, public officials and other professionals from 43 sub-Saharan countries in East Africa, West Africa and Southern Africa have received GBDI training and consultation in biodiversity, biotechnology and related law. We are also deploying our professional resources to provide consultations for public- and private-sector institutions that want to expand their presence in promising markets for bioresources -- or move into new markets.

A major goal of our current efforts is a program designed to overcome the barriers that have stood in the way of passing biosafety regulation throughout Africa. Biotechnology in Africa faces a critical challenge. Not one country in Africa has yet to enact biosafety regulatory law, despite the fact that biosafety regulations are mandated by the Biosafety Protocol. Unless African leaders pass biosafety regulatory laws – and implement them effectively – Africa will never adopt and develop biotechnology, or acquire biotechnology through technology transfer from the U.S. or other trading partners.

In addition, we are planning to work with the Republic of the Congo (Brazzaville) and the U.S. Embassy in Brazzaville to organize a conference for African heads of state, to focus on the critical issue of cassava blight and how biotechnology offers a great solution to it.

Some of these programs that we want to implement will depend on the availability of funds.

